इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 9814 (1981): Lead-acid storage batteries for marine use
[ETD 11: Secondary Cells and Batteries]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

IS : 9814 - 1981

(Reaffirmed 2003)

Indian Standard

SPECIFICATION FOR LEAD-ACID STORAGE BATTERIES FOR MARINE USE

UDC 621·355·2 : 629·12

© *Copyright* 1981

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Rs 5·00 Gr 3

November 1981

Indian Standard
SPECIFICATION FOR LEAD-ACID STORAGE BATTERIES FOR MARINE USE

Secondary Cells and Batteries Sectional Committee, ETDC 11

Chairman	*Representing*
Dr H. V. K. Udupa	Central Electrochemical Research Institute (CSIR), Karaikudi
Members	
Shri P. V. Vasudevarao (*Alternate* to Dr H. V. K. Udupa)	
Shri S. K. Biswas Gupta	Directorate General of Mines Safety, Dhanbad
Shri N. K. Sen (*Alternate*)	
Cdr A. M. Boopathi	Naval Headquarters (Ministry of Defence), New Delhi
Lt Cdr V. Balachandran (*Alternate*)	
Shri S. K. Chakraborty	Small Industries Service Institute, New Delhi
Shri K. L. Garg	Directorate General of Supplies and Disposals (Inspection Wing), New Delhi
Shri R. P. Sehgal (*Alternate*)	
General Manager (T)	Directorate General of Posts & Telegraphs (Department of Communication), New Delhi
Addl General Manager (I) (*Alternate*)	
Shri G. R. Ghosh	Controllerate of Inspection Electronics, Ministry of Defence (DGI), Bangalore
Shri Surjit Singh (*Alternate*)	
Joint Director Standards (Electrical) TLM, RDSO	Railway Board (Ministry of Railways)
Deputy Director Standards (Electrical)-DI RDSO (*Alternate*)	
Shri B. S. Kedare	The Standard Batteries Ltd, Bombay
Shri S. S. Wagle (*Alternate*)	
Shri G. L. Keswani	Directorate General of Technical Development, New Delhi
Shri A. R. Kesavalu (*Alternate*)	
Lt Col B. R. Mahajan	Directorate of Electrical Mechanical Engineers, Ministry of Defence, New Delhi
Major M. M. K. Sindhi (*Alternate*)	
Shri B. Mukhopadhyay	National Test House, Calcutta
Shri J. P. Srivastava (*Alternate*)	

(*Continued on page* 2)

© *Copyright* 1981
INDIAN STANDARDS INSTITUTION
This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act

(*Continued from page* 1)

Members	*Representing*
Shri H. C. Pande	Directorate of Technical Development and Production (Air), New Delhi
Shri V. K. Sharma (*Alternate*)	
Shri H. V. Pande	Willard India Ltd, New Delhi
Shri I. S. Majunath (*Alternate*)	
Shri N. M. Patel	Gujarat Electricity Board, Vadodara
Shri M. B. Patel	
Shri C. Ranganathan	Lucas TVS Ltd, Madras
Shri S. T. Shrin (*Alternate*)	
Shri K. Ramakrishna Rao	Andhra Pradesh State Electricity Board, Hyderabad
Shri K. V. Kumar Dutt (*Alternate*)	
Shri Sachindra Prasad Saha	Indian Batteries Manufacturers' Association, Calcutta
Shri Samrendra Prasad Shah (*Alternate*)	
Shri K. R. Sekhar	AMCO Batteries Ltd, Bangalore
Shri J. Sengupta	Chloride India Ltd, Calcutta
Shri A. P. deSousa (*Alternate*)	
Shri S. Srinivasan	The Mysore Electrochemical Works Ltd, Bangalore
Shri A. K. Joishy (*Alternate*)	
Shri N. K. Srivastava	Rail India Technical and Economic Services Ltd, New Delhi
Shri S. R. Saha (*Alternate*)	
Shri S. P. Sachdev, Director (Elec tech)	Director General, ISI (*Ex-officio Member*)

Secretary

Smt G. M. Pylee
Assistant Director (Elec tech), ISI

Indian Standard
SPECIFICATION FOR LEAD-ACID STORAGE BATTERIES FOR MARINE USE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 April 1981, after the draft finalized by the Secondary Cells and Batteries Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard has been prepared from the tests that are to-day adopted in the case of lead-acid batteries that are principally used for starting of an engine as apart from telecommunication.

0.3 The batteries which are covered in this standard, form a part of the essential equipment in a marine vessel and their location or position of installation is not expected to be altered very frequently.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements and tests for lead-acid storage batteries that are commonly used in marine duty.

2. TERMINOLOGY

2.1 For the purpose of this standard the definitions given in IS : 1885 (Part VIII)-1965† and IS : 8320-1976‡ shall apply.

---

*Rules for rounding off numerical values (*revised*).

†Electrotechnical vocabulary: Part VIII Secondary cells and batteries.

‡General requirements and methods of tests for lead-acid storage batteries.

3. CLASSIFICATION

3.1 The storage batteries covered in this standard shall be classified as follows:

a) *High Power Batteries* — Batteries that supply intermittent heavy cranking power to start internal combustion engines.

b) *Low Power Batteries* — Batteries that supply electric power to operate telecommunication and emergency lighting for limited periods.

4. MATERIALS, CONSTRUCTION AND WORKMANSHIP

4.1 Batteries for marine duty shall be designed to be robust in construction and highly resistant to vibrations in service.

4.2 The battery shall be assembled in monobloc container or single cell construction conforming to IS : 1146-1972*. Each cell shall be fitted with an anti-splash type vent plug and have a venting system that arrests acid spray and splashing of acid without impeding the free escape of gases. Where necessary, the battery shall be encased in seasoned hard wood and provided with lifting arrangement.

4.3 Electrolyte — The provisions of **3.2** of IS : 8320-1976† shall apply.

For the purpose of tests, the specific gravity of the electrolyte with the battery in fully charged condition corrected to a temperature of 27°C shall be between 1·275 and 1·285.

4.4 Cell Lids — The cell lids shall be of hard rubber or plastic. If hard rubber is used, the design shall be of the deep-sealing type suitable for use with bituminous sealing compounds with close fitting terminal post outlet and with vent holes suitable for accommodating the vent plugs. If the lids are of plastic, heat-sealing or an adhesive/plastic cement may be employed for sealing.

4.5 Sealing Compound — Provisions of **3.1.4** of IS : 8320-1976† shall apply.

4.6 Water — Provisions of **3.3** of IS : 8320-1976† shall apply.

4.7 Separators — Provisions of **3.4** of IS : 8320-1976† shall apply.

4.8 Bolts and Nuts — The bolts and nuts when used shall be effectively lead coated to prevent corrosion.

4.9 Terminals — All terminals shall be correctly and securely positioned. They shall be free from corrosion, surface irregularities or other defects which would impair their contact making properties.

---

*Rubber and plastics containers for lead-acid storage batteries (*first revision*).

†General requirements and methods of tests for lead-acid storage batteries.

5. REQUIREMENTS

5.1 The batteries shall work satisfactorily at ambient temperatures up to 45°C.

5.2 The construction shall be such that the electrolyte shall not spill when the battery is tilted up to 45° from vertical in any direction.

5.3 Special care shall be taken to make the batteries resistant to corrosion and salt water spray as is normally encountered in marine service.

5.4 The cells shall be grouped in crates or trays of rigid construction and suitable material equipped with handles to facilitate handling. The number of cells in a crate or tray will depend on the weight and on the space available for installation. The weight of a single crate or tray with the batteries shall not exceed 100 kg. This shall not apply to cells, the weight of which is such that grouping in crates or tray is impracticable.

6. TESTS

6.1 Classification of Tests

6.1.1 The following shall constitute the type tests:

a) Physical examination (**6.4**),
b) Dimensions and layout (**6.5**),
c) Air pressure test (**6.6**),
d) Rated capacity (**6.7**),
e) High rate discharge (HRD) at normal temperature (for high power batteries only) (**6.8**),
f) High rate discharge at low temperature (high power batteries only) (**6.9**),
g) Loss of capacity on storage (**6.10**),
h) Life test (**6.11**),
j) Vibration test (**6.12**),
k) Electrolyte spillage test (**6.13**), and
m) Salt mist test (**6.14**).

6.1.1.1 Samples for the type tests shall be drawn at random by the inspecting or testing authority and the sequence of type tests and the number of samples required shall be in accordance with Appendix A.

6.1.1.2 *Criteria for conformity for type tests* — Provisions of **5.1.3.1** of IS : 8320-1976* shall apply.

---

*General requirements and methods of tests for lead-acid storage batteries.

6.1.2 The following shall constitute the acceptance test:

- a) Physical examination (**6.4**),
- b) Dimensions and layout (**6.5**),
- c) Air pressure test (**6.6**), and
- d) Rated capacity (for high power batteries only) (**6.7**).

6.1.2.1 *Sampling scheme and criteria for acceptance* — Provisions of **5.1.4** of IS : 8320-1976* shall apply.

6.1.3 The following shall constitute routine tests:

- a) Physical examination (**6.4**),
- b) Dimensions and layout (**6.5**), and
- c) Air pressure test (**6.6**).

6.2 Test Equipment — Provisions of **5.2** of IS : 8320-1976* shall apply.

6.3 Temperature for Test — Provisions of **5.3** of IS : 8320-1976* shall apply.

6.4 Physical Examination — The batteries shall be examined for conformity with **4** and **5** for high power batteries or low power batteries as the case may be.

6.5 Dimensions and Layout — Types of batteries normally used for marine purposes and their maximum overall dimensions are under consideration and would be included later.

6.6 Air Pressure Test — The batteries shall pass the air pressure test in accordance with **5.7** of IS : 8320-1976*.

The air pressure test shall be carried out in dry uncharged condition only.

6.7 Rated Capacity

6.7.1 *First Charge* — For test purpose the battery shall be received in dry uncharged condition. It shall be filled with electrolyte and charged in accordance with manufacturer's instructions.

6.7.2 *Test for Capacity at 10-hour Rate* — After standing on open circuit for not less than 12 hours nor more than 24 hours from the completion of a full charge and with an electrolyte temperature of 20° to 30°C the battery shall be discharged through a suitable resistance at a constant current $I = 0{\cdot}1 \times C_{10}$ amperes and the discharge shall be stopped when the closed circuit voltage across the battery terminal falls down to $1{\cdot}75 \times n$ Volts where n is the total number of cells in series in the battery.

6.7.3 *Requirement* — The capacity obtained in the first discharge shall not be less than 85 percent of the rated capacity and battery shall reach its rated capacity within 10 cycles.

---

*General requirements and methods of tests for lead-acid storage batteries.

6.8 High Rate Discharge at Normal Temperature (for High Power Batteries Only) — The test shall be conducted on a fully charged battery after completion of the capacity test.

The high rate discharge at normal teperature shall be determined by discharging a fully charged battery at a constant current of $I = 3 \times C_{10}$ amperes, the discharge being stopped when the battery voltage has fallen to 4·00 V for a 6-volt battery and 8·00 V for a 8-volt battery.

The initial temperature of the electrolyte measured in the central cell (s) shall be 27 ± 2°C. During discharge the terminal voltage shall be taken at 5 to 7 seconds after the start and at 30 seconds intervals thereafter.

6.8.1 *Requirements* — The battery shall meet the minimum requirements as specified in Table 1.

TABLE 1 REQUIREMENTS OF HIGH RATE DISCHARGE AT NORMAL TEMPERATURE

Initial Temperature of the Electrolyte	Discharge Current	Minimum Discharge Time		Battery Terminal Voltage			
				Initial at 5 to 7 s		Final	
°C	A	min	s	6-volt	12-volt	6-volt	12-volt
27±2	$3C_{10}$	3	00	4·50	9·00	4·00	8·00

6.9 High Rate Discharge at Low Temperature (for High Power Batteries Only) — The test shall be conducted on a fully charged battery.

The high rate discharge at low temperature shall be determined by discharging the battery at a constant current of $I = 3 \times C_{10}$ amperes, the discharge being terminated when the terminal voltage has fallen to 3·00 V for a 6-volt battery and 6·00 V for a 12-volt battery.

The initial temperature of the electrolyte measured in the central cells shall be 0 ± 2°C. During discharge the terminal voltage shall be taken at 5 to 7 seconds after the start and at 30 seconds intervals thereafter.

6.9.1 *Requirements* — The battery tested shall meet the minimum requirements as specified in Table 2.

TABLE 2 REQUIREMENTS OF HIGH RATE DISCHARGE AT LOW TEMPERATURE

Initial Temperature of the Electrolyte	Discharge Current	Minimum Discharge Time		Battery Terminal Voltage			
				Initial at 5 to 7 s		Final	
°C	A	min	s	6-volt	12-volt	6-volt	12-volt
0±2	$3C_{10}$	2	00	4·20	8·40	3·00	6·00

6.10 Loss of Capacity on Storage — The test shall be performed in accordance with **5.10** of IS : 8320-1976*, except that the capacity shall be measured in accordance with **6.7**.

6.10.1 *Requirements* — The loss of capacity shall not exceed 20 percent of the initial capacity.

6.11 Life Test

6.11.1 The life test is to be carried out on at least two batteries which have successfully passed the tests specified in **6.7**, **6.8** and **6.9**.

6.11.2 After being fully charged the batteries shall be connected to a circuit which will enable them to be subjected to a series of discharges and charges as follows:

Discharge for one hour at an average current of $I = 0{\cdot}1\ C_{10}$A.

Charge for five hours at an average current of $I = 0{\cdot}1\ C_{10}$A.

Throughout the life test cycle, the batteries shall be immersed in a tank of water, the temperature of which is maintained at 43 ± 2°C.

The batteries shall be so immersed that the top of the battery containers shall not be more than 25 mm above the water level in the tank. If several batteries are placed in the same tank, a distance of at least 25 mm shall be maintained between them. The distance between the batteries and the sides of the tank shall also be at least 25 mm.

6.11.3 After each series of 36 discharge and charge cycles, the batteries shall be disconnected from the circuit. They shall be left on open-circuit in the tank for 96 hours. After this open-circuit stand, the batteries shall be subjected to a high rate discharge at the current shown in Table 4. On completion of this discharge, the batteries shall be fully recharged at the normal rate.

The combination of 36 discharge and charge cycles, the 96-hour open-circuit stand, the high rate discharge and the recharge together constitute one complete unit of life test.

During this test the batteries shall be periodically topped up with pure water so as to maintain the correct electrolyte level. The specific gravity of the electrolyte in the fully charged battery at each capacity test shall be maintained within limits of 1·28 ± 0·01, if necessary, by adjustment.

6.11.4 *Requirements*

6.11.4.1 *For high power batteries* — The number of life test units shall not be less than 6 and for each of the 6 high rate checking discharges the duration of discharge shall not be less than 2 minutes 30 seconds, before the terminal voltage specified in Table 3 is reached for both flat and tubular plate construction.

---

*General requirements and methods of tests for lead-acid storage batteries.

TABLE 3 REQUIREMENTS FOR LIFE TEST FOR HIGH POWER BATTERIES

(*Clause* 6.11.4.1)

INITIAL TEMPERATURE OF THE ELECTROLYTE °C	DISCHARGE CURRENT A	MINIMUM DISCHARGE TIME		FINAL BATTERY TERMINAL VOLTAGE	
		min	s	6-volt	12-volt
43±2°C	$3C_{10}$	2	30	4·00	8·00

6.11.4.2 *For low power batteries* — The number of life test units shall not be less than 3 and for each of the 3 high rate checking discharges the discharge duration shall not be less than 4 minutes before the terminal voltages specified in Table 4 are reached.

TABLE 4 REQUIREMENTS FOR LIFE TEST FOR LOW POWER BATTERIES

(*Clauses* 6.11.3 *and* 6.11.4.2)

INITIAL TEMPERATURE OF THE ELECTROLYTE °C	DISCHARGE CURRENT A	MINIMUM DISCHARGE TIME		FINAL BATTERY TERMINAL VOLTAGE	
		min	s	6-volt	12-volt
43±2°C	$3C_{10}$	4	0	4·00	8·00

6.12 Vibration Test — The test shall be performed in accordance with IS : 2106 (XVI)-1971*. The samples shall be first tested for capacity test at 10-hours rate before putting into vibration test. The battery shall be charged at $0 \cdot 1C_{10}$A. The test consists of vibrating the batteries at a frequency of 16 Hz with a total displacement of 5 mm for a period of 2 hours. During vibration the batteries shall be discharged at the 10-hour rate.

6.12.1 *Requirements* — There shall not be any sudden drop, either in the current or voltage values and there shall be no spillage of electrolyte during the test.

6.13 Electrolyte Spillage Test — The battery shall be rocked 10 times from side to side up to an angle of 45° from the neutral position. The battery shall remain in each tilted position for at least 5 seconds. At the end of the test, there shall be no spillage of electrolyte when visually examined.

---

*Environmental tests for electronic and electrical equipment: Part XVI Vibration test.

6.14 Salt Mist Test — The test shall be performed in accordance with IS : 2106 (Part XVIII)-1973*. After the test the battery shall be free from corrosion.

APPENDIX A

(*Clause* 6.1.1.1)

SEQUENCE OF TYPE TEST AND NUMBER OF SAMPLES

Test	*Battery Number*							
	High Power Batteries						Low Power Batteries	
	1	2	2	4	5	6	1	2
Physical examination	×	×	×	×	×	×	×	×
Dimensions and layout	×	×	×	×	×	×	×	×
Air pressure test	×	×	×	×	×	×	×	×
Rated capacity	×	×	×	×	×	—	×	×
High rate discharge at normal temperature	×	×	×	×	—	—	—	—
High rate discharge at low temperature	×	×	—	—	—	—	—	—
Loss of capacity on storage	—	—	×	×	—	—	×	—
Life test	×	×	—	—	—	—	—	×
Vibration test	—	—	—	—	×	—	×	—
Electrolyte spillage test	×	×	×	×	×	—	×	—
Salt mist test	—	—	—	—	—	×	—	×

---

*Environmental tests for electronic and electrical equipment: Part XVIII Salt mist test.

INDIAN STANDARDS

ON

SECONDARY CELLS AND BATTERIES

IS :

1145-1962	Lead-acid storage batteries for motor cycles, auto-rickshaws and similar vehicles (*revised*)
1146-1972	Rubber and plastics containers for lead-acid storage batteries (*first revision*)
1651-1970	Stationary cells and batteries, lead-acid type (with tubular positive plates) (*first revision*)
1652-1972	Stationary cells and batteries, lead-acid type (with plante positive plates) (*first revision*)
1846-1961	Lead-acid storage batteries for aircraft (aerobatic and non-aerobatic)
1885 (Part VIII)-1965	Electrotechnical vocabulary: Part VIII Secondary cells and batteries
2512-1978	Miners' cap lamp batteries (lead-acid type) (*first revision*)
5154-1969	Lead-acid traction batteries
6071-1970	Synthetic separators for lead-acid batteries
6304-1971	Stationary cells and batteries, lead-acid type with pasted plates
6848-1979	Lead-acid batteries for train lighting and airconditioning services (*first revision*)
7372-1974	Lead-acid storage batteries for motor vehicles (*superseding* IS : 395-1962 *and* IS : 985-1962)
7624-1975	Lead-acid starter batteries for diesel locomotives and rail cars
7660-1975	Lead-acid batteries for electric locomotives and electrical multiple units
8320-1976	General requirements and methods of tests for lead-acid storage batteries

---

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 26 60 21, 27 01 31 **Telegrams : Manaksanstha**

Regional Offices :		Telephone
Western : Novelty Chambers, Grant Road	BOMBAY 400007	37 97 29
Eastern : 5 Chowringhee Approach	CALCUTTA 700072	27 50 90
Southern : C.I.T. Campus, Adyar	MADRAS 600020	41 24 42
Northern : B69, Phase VII	S.A.S. NAGAR (MOHALI) 160051	—
Branch Offices :		
'Pushpak', Nurmohamed Shaikh Marg, Khanpur	AHMADABAD 380001	2 03 91
'F' Block, Unity Bldg, Narasimharaja Square	BANGALORE 560002	2 76 49
Gangotri Complex, Bhadbhada Road, T.T. Nagar	BHOPAL 462003	6 27 16
22E Kalpana Area	BHUBANESHWAR 751014	5 36 27
5-8-56C L. N. Gupta Marg	HYDERABAD 500001	22 10 83
R-14 Yudhister Marg, C Scheme	JAIPUR 302005	6 98 32
117/418 B Sarvodaya Nagar	KANPUR 208005	4 72 92
Patliputra Industrial Estate	PATNA 800013	6 28 08
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27

Printed at Delhi Printers, New Delhi, India